The Aeolus Data Innovation and Science Cluster DISC - Overview and First Results

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Already within the first weeks after the launch of ESA´s Earth Explorer mission Aeolus on 22 August 2018, the spaceborne wind lidar ALADIN (Atmospheric LAser Doppler INstrument) provided atmospheric backscatter measurements on 5 September and wind profiles on 12 September. This swift availability of observations from ALADIN after launch is considered as a great success for ESA, space industry and algorithm and processor developer teams. These teams from scientific institutes, numerical weather prediction (NWP) centres, companies and from ESTEC and ESRIN continuously improved and tested the retrieval algorithms and processors using sophisticated end-to-end simulation tools and experience gained with the airborne demonstrator for Aeolus. ALADIN as the first wind-lidar in space is not only based on new technologies for lasers, optical interferometers and detectors, but also the retrieval algorithms had to be developed without any heritage from earlier space-borne wind lidars.

This cooperation from the development phase of Aeolus will be continued and extended within a new framework for exploitation activities of Earth Explorer missions named Data Innovation and Science Cluster (DISC) during the phase E2 starting after completion of the commissioning phase activities. The Aeolus DISC activities range from instrument monitoring including calibration and characterization to algorithm refinement, and towards a continuous evolution of the processors for all product levels. Product quality monitoring plays an essential role including validation of products from external validation teams, whose results will be synthesised by DISC experts and eventually will lead to further algorithm updates. The DISC consortium will provide support to ESA ranging from anomaly resolving for the payload data ground segment to support in decisions for instrument operation, calibration and providing support to the Aeolus Quality Working Group (QWG). Also support to Aeolus users from the validation teams, science and NWP communities will be provided by DISC experts.

The aim of the Aeolus mission is to provide global observations of vertical profiles of one component of the horizontal wind vector with sufficient accuracy and precision to demonstrate a positive impact on NWP analysis and forecasts. All activities within the DISC are targeted towards supporting this overall objective. Therefore impact experiments with NWP models are building a major activity within DISC. These impact experiments, the product monitoring activities, or the feedback from the user community will eventually guide further recommendations for algorithm and processor evolution. Both forward-engineering (or bottom-up) approaches as well as complementary reverse-engineering (or top-down) approaches will be practiced.

The monitoring of the Aeolus data product quality and instrument performance, the refinement of retrieval algorithms or the evolution of the processors strongly benefit from monitoring of Aeolus data with NWP models. This NWP monitoring provides temporally continuous comparisons of Aeolus observations with NWP models for all altitudes and over all geographical regions, and this with almost immediate feedback on the data quality. The large potential of this approach was already successfully demonstrated during the commissioning phase, where a systematic error in Rayleigh winds for one specific range gate was spotted by comparison of several orbits of Aeolus data with the ECMWF model. This bias in Rayleigh winds could be traced back to one suspicious pixel on the Rayleigh ACCD. Investigations for correcting these effects on pixel level are on-going. This clearly demonstrates the successful approach of combining the expertise on the instrument, retrieval algorithms, and NWP monitoring.

An overview of the DISC activities as well as first results from instrument performance and data product quality will be discussed.